

THE IDENTITY OF *TALITROIDES ALLUAUDI*
(CHEVREUX) (CRUSTACEA: AMPHIPODA: TALITRIDAE)
WITH NOTES ON A NEW LOCALITY

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Abstract. — A lectotype of *Talitroides alluaudi* (Chevreux) is designated from the type-series and described to remove taxonomic confusion on the identity of this species. The discovery of this species in Israel is briefly discussed.

Examination of terrestrial talitrids collected from southern parts of Israel revealed two genera and three species, one of which proved to be *Talitroides alluaudi*. This species is one of the most widespread landhoppers, known from the tropics to warm-temperate regions and hothouses in Europe and North America (Friend & Richardson 1986), though so far not known from the Levant. Although some authors have remarked on various characters, especially concerning the pleopods, of this species (Medcof 1940, Palmén 1949, Andersson 1962), no full descriptions or figures have been published since the original description of Chevreux (1896, 1901). Close examination of material from Israel, with reference to Chevreux's descriptions, revealed a few minor but distinct discrepancies between them as well as between previous descriptions of *T. alluaudi*.

Chevreux (1896) described this species three times from two localities. He gave a brief original description of this species on the basis of material procured from hothouses at the Paris Museum ("les serres du Muséum de Paris"). In this paper he mentioned that the Paris material was identical to that collected from the Seychelles. Although he did not specify the locality of the type, the title of his paper suggests that Paris is the probable type locality. Shoemaker (1936), however, assumed that the Seychelles was the type locality. In 1901, Chevreux treated the Seychelles material in de-

tail. The Paris material was described again in 1925 (Chevreux & Fage 1925) with illustrations. A study of these three descriptions discloses the following apparent unconformity in some characters: The Paris 1896 and Seychelles material have well-developed brood plate on female gnathopod 2, though this is lacking in the Paris 1925 material, and; the Seychelles material has 1-articulated and 3-articulated inner ramus on pleopods 1 and 2, respectively, though the Paris 1925 material has 4-articulated and 1-articulated inner ramus, respectively (no description of pleopods for the Paris 1896 material). If these descriptions are taken authentically, we could recognize three species in the Chevreux's concept of *T. alluaudi*: two from Paris and one from the Seychelles. And if the Paris 1896 material was from the Seychelles, as assumed by Shoemaker (1936), two species may be discernible, from Paris and the Seychelles, respectively. Medcof (1940) has also pointed out some confusion in the earlier descriptions of this species, which he attributed to geographical variation ("based on examinations of specimens collected from areas sometimes widely separated"). Since Medcof's analysis of variation is limited to the pleopod structure, he did not notice the variation in the brood plate. In addition, material from Israel at hand displays a peculiar feature of the pereopod dactyl, which was described in the Seychelles material differently, and was not mentioned for the Par-

is material. Thus it is necessary to determine the original concept of *T. alluaudi* through direct reference to the type-series.

The type material of *Talitrus alluaudi* deposited in Muséum National d'Histoire Naturelle in Paris consists of preserved specimens from four localities (MNHN Paris Am 4500, 4501, 4502, 4503) and slides (MNHN Paris Am 4504). The label on the slides ("Serre du Muséum") suggests that they comprise the type specimen. Unfortunately the condition of the slides is so bad that it is not possible to discriminate the pertinent characters, and all the preserved specimens are from other than the Paris Museum. Thus the lectotype is selected from the locality nearest to the Paris Museum and described to resolve the problem of *T. alluaudi*. Material from Israel and Hawaii is also examined.

Systematic Account

Talitroides alluaudi (Chevreux, 1896)

Figs. 1, 2

Talitrus Alluaudi Chevreux, 1896:112, figs. 1–4; 1901:389, figs. 1–6.—Chevreux & Fage, 1925:270, figs. 280–281.

Orchestia senni Menzel, 1911:438, figs. 4–9
Talitroides alluaudi.—Palmén, 1949:61, figs. 1–12.—Andersson, 1962:211, figs. 1–3.—Bousfield, 1984:210.

Material examined.—Two females (5.5 mm—lectotype, 5.0 mm—paralectotype), from Serres de la Ville de Paris, Boulogne sur Seine, France (MNHN Paris Am 4500); 1 female (5.0 mm), from Îles Séchelles, Mahé, Auct. det 1901 (MNHN Paris Am 4502); 2 females (6 mm and 7 mm), from Ponta Delgada, Île S. Michel, Açores, Aug 1930, M. Mequignon collector, (MNHN Paris Am 4503); 5 females (up to 5.5 mm), from Ben Gurion Univ. campus, Beersheba, Israel, bamboo stands, 10 Dec 1987, Y. Margalit collector (Morino Cat. No. T.766), 4 Mar 1989, R. Ortal collector (Morino Cat. No. T836); 1 female (4.5 mm), from Hal-

awa, Molokai Is., Hawaii, 9 Mar 1968, Sinonaga collector (Morino Cat. No. T.868); 1 female (4.8 mm), from Kokee, Kauai Is., Hawaii, 11–12 Mar 1968, Sinonaga collector (Morino Cat. No. T.869).

Description of lectotype.—Eye small in size, subround. Inferior antennal sinus medium deep. Head longer than deep.

Antenna 1 exceeding mid-point of peduncular article 5 of antenna 2, peduncular articles subequal in length; flagellum a little shorter than peduncle, 6-articulated. Antenna 2: peduncle weakly spinose, article 5, 1.79 times as long as article 4; flagellum subequal to peduncle in length, 11-articulated.

Upper lip: as wide as deep. Mandible: incisor chitinized strongly, brown in color, 5-dentate; left lacinia chitinized as incisor, 4-dentate; right lacinia not strongly chitinized, with 3 cusps; spine rows of 2 broad plumose bristles. Lower lip normal. Maxilla 1: innermost spine of outer plate leaning medially, outermost 2 spines without denticles; palp small, joint of article 2 indistinct. Maxilla 2: inner plate distolaterally produced into pointed tip, several medio-distal setae plumose. Maxilliped: inner plate apically truncate, with 3 weak spine-teeth, increasing in size laterally, and with several plumose stiff setae; outer plate weakly arcuate with rounded apex, weakly setose; palp articles 2 and 3 slender, with a few stiff setae distally, article 2 with remnant of medial lobe represented by elongate setae, article 4 partially fused to article 3.

Gnathopod 1: coxa truncate distally, lower margin spinose, inner shelf weak, with a spine; basis broadened distally; carpus 1.50 times as long as propod; propod simple, gradually narrowed to base of dactyl, posterior margin with 3 stiff long spines and several shorter submarginal spines on inner and outer sides, anterior margin with 2 spine clusters; dactyl cusped anteriorly, base with a stiff seta posteriorly, nail as long as base. Gnathopod 2: coxa cusped posteriorly, as deep as wide, lower margin rounded and

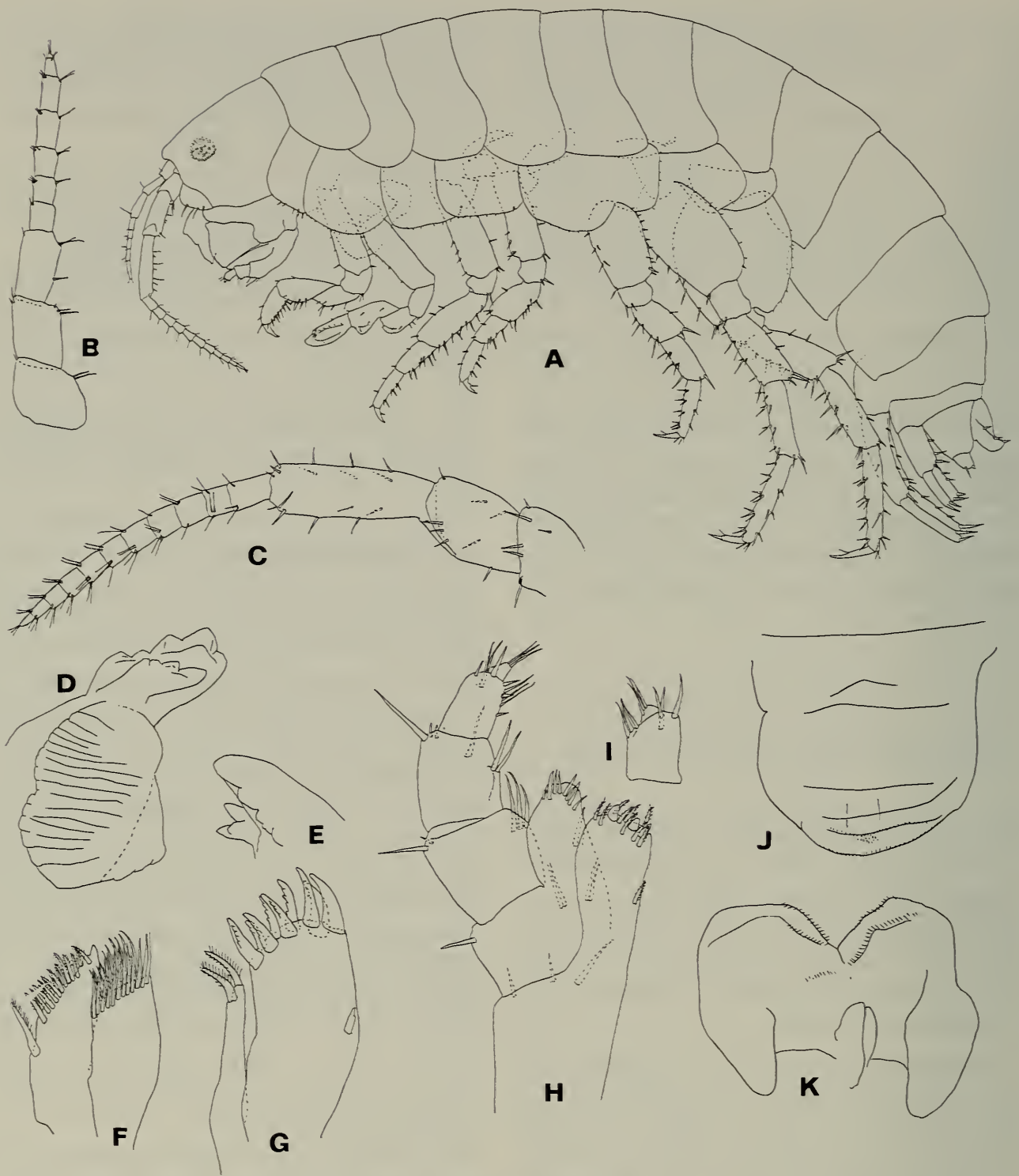


Fig. 1. *Talitroides alliaudi* (Chevreux). Boulogne sur Seine, France. The lectotype, MNHN Am 4500-1 (female, 5.5 mm body length). A, lateral view; B, antenna 1; C, antenna 2; D, left mandible; E, right mandible; F, maxilla 2; G, maxilla 1; H, maxilliped; I, distal part of right palp of maxilliped; J, upper lip; K, lower lip.

weakly spinulose; basis slender, anterior margin spinulose; merus and carpus with tumescence posteriorly, carpus as long as propod; propod anterior margin weakly setose, posterior tumescent lobe well developed, exceeding dactyl by half of propod length.

Coxae 3 and 4 shallower than wide, with

a stiff seta posteroventrally, and a few spinules ventrally. Coxa 5 anterolobate, anterior lobe deeper than that of pereopod 4. Coxa 6: posterior lobe truncate distally, anterior margin of the lobe vertical. Coxa 7 shallow.

Pereopods 3-7 cuspidactylate, propod lacking hinge spine, dactyl base with a stiff

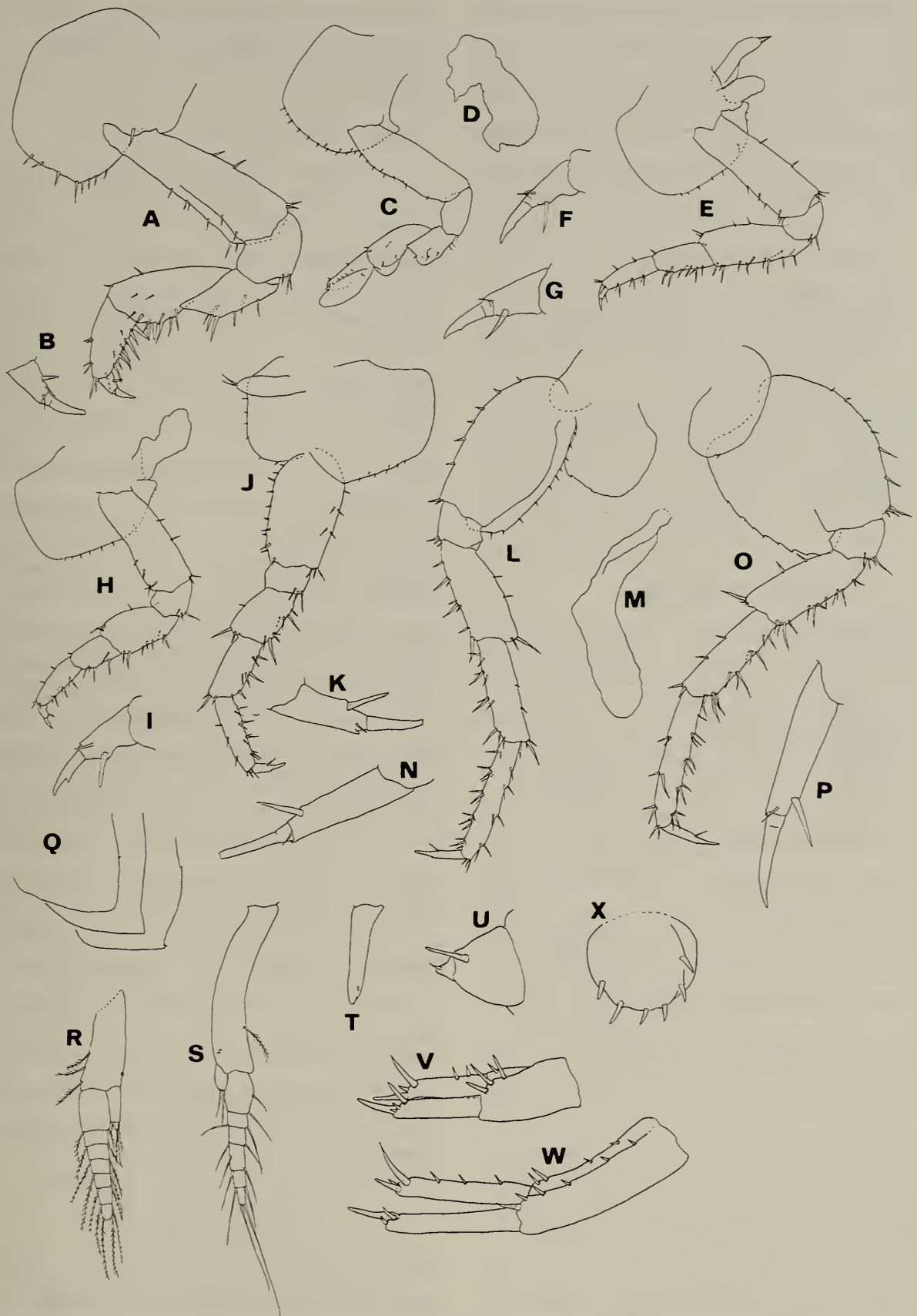


Fig. 2. *Talitroides alluaudi* (Chevreux). Boulogne sur Seine, France. A, gnathopod 1; B, dactyl of gnathopod 1; C, gnathopod 2; D, coxal gill of gnathopod 2; E, pereopod 3; F & G, dactyl of pereopod 3; H, pereopod 4; I, dactyl of pereopod 4; J, pereopod 5; K, dactyl of pereopod 5; L, pereopod 6; M, coxal gill of pereopod 6; N, dactyl of pereopod 6; O, pereopod 7; P, dactyl of pereopod 7; Q, abdominal side plates 1-3; R, pleopod 1; S, pleopod 2; T, pleopod 3; U, uropod 3; V, uropod 2; W, uropod 1; X, telson. G = Azores, MNHN Am 4503-1 (female 6.0 mm); M = Boulogne sur Seine, France, paralectotype MNHN Am 4500-2 (female 5.0 mm); others = Boulogne sur Seine, France, lectotype MNHN AM 4500-1 (female 5.5 mm).

seta. Pereopod 3: dactyl base weakly pinched, nail with slight prominence at middle on posterior margin. Pereopod 4 shorter than pereopod 3, basis weakly arcuate, dactyl base pinched, nail with sharp dentition posteriorly. Pereopod 5 longer than pereopod 4, basis narrow with a submarginal spine at posterodistal corner, lacking posterodistal lobe. Pereopod 6 similar to but much shorter than pereopod 5, dactyl nail almost straight. Pereopod 7 slightly longer than pereopod 6, basis expanded posteriorly, as deep as wide.

Coxal gill of gnathopod 2 as long as basis, distal margin with crenulations. Coxal gills of pereopods 3–5 small, constricted at middle. Coxal gill of pereopod 6 longer than basis, reverse L-shaped. Brood plates confined to pereopods 3–5, small and slender with 2–3 simple setae apically.

Abdominal side plate 1 rounded posteroventrally. Plates 2 and 3 bluntly pointed posteroventrally, posterior margins weakly spinulose. Pleopod 1: peduncle weakly arcuate, with 3 plumose setae on outer margin, with 2 retinaculae; outer ramus 7-articulated; inner ramus shorter than half of outer ramus, 2-articulated. Pleopod 2 a little shorter than pleopod 1, peduncle outer margin with a plumose seta, outer ramus 6-articulated, inner ramus 1-articulated with apical setae. Pleopod 3 small and slender, 0.4 times as long as peduncle of pleopod 2, with 2 spinules subapically, lacking rami.

Uropod 1: peduncle with marginal spines on both edges, distolateral spine strong, closely set to distomarginal spine; rami subequal in length and shorter than peduncle, with elongate apical spines; outer ramus marginally bare; inner ramus with 3 marginal spines. Uropod 2: peduncle with marginal spines distally; rami subequal to each other and to peduncle in length, with elongate apical spines; outer ramus marginally bare; inner ramus with spines proximally. Uropod 3 very small, not reaching tip of telson, subtriangular in shape; peduncle broad at base with a strong spine ventrally;

ramus small, conical, partially fused to peduncle, with a spinule at tip. Telson broad, apically rounded with apical and 3–4 lateral spines.

Male. — Not known.

Variations. — Eye in the Israeli material is somewhat larger than that of the lectotype. Number of flagellar articles ranges from 4 to 6 on antenna 1 and from 8 to 9 on antenna 2 in the material examined, tending to increase with body size. Marginal setae on propod anterior margin of gnathopod 2 also show variation in number: Seychelles and Hawaiian Islands material lacks them, Israeli material with 1–2 setae, Azores material with 0–2. Swiss material (Menzel 1911, as *Orchestia senni*) also has one seta. Inner rami of pleopods 1 and 2 fluctuate in the number of articles: from 1 to 4 (mostly 2) articles in pleopod 1; 1, exceptionally 3 (in Azores material, 7 mm body length) articles in pleopod 2. Only this larger specimen from the Azores has reduced ramus in pleopod 3, otherwise lacking them. For each specimen examined, article number of inner ramus of pleopod 1 is higher than, rarely same as that of pleopod 2. This range and pattern of variation in pleopods is in accord with those in the other geographical populations: Basel, Switzerland (Menzel 1911); Urbana, Illinois, U.S.A. (Medcof 1940); Finland (Palmén 1949) and the Canary Islands (Andersson 1962). Dactyl nail of pereopod 3 has usually very weak prominence at the posterior middle. The Azores material (6.0 mm) has, however, distinct prominence (Fig. 2G) which is rather similar to the dentition of pereopod 4.

Discussion

Most of the variations mentioned above occur within a given population rather than between geographically separated populations. Thus it is not possible to recognize more than one species amongst the material examined. All the material lacks a brood plate on female gnathopod 2, and has dac-

tylar dentition on pereopod 4 (rarely also on pereopod 3). Chevreux (1901) mentioned the dactylar dentition on pereopod 5, not on pereopod 4, in his Seychelles material. At the same time, in our specimens, the inner ramus of pleopod 1 has more articles than that of pleopod 2, and never less, as by Chevreux (1901). Thus it is possible that Chevreux treated an exceptional specimen or more probably some confusion occurred during the preparation of his material.

The present species is most closely related to *Talitroides topitotum* (see Bousfield 1984). Friend & Lam (1985) listed several discriminating characters between *T. alluaudi* and *T. topitotum*. In addition, the following ones are to be mentioned: *T. alluaudi* has gnathopod 2 without brood plate, strongly chitinized mandible, maxilla 2 with distally pointed inner plate, and pereopod 4 with dactylar dentition. These features are rather peculiar among landhoppers. *Talitroides alluaudi* also resembles *Arcitalitrus sylvaticus*, a non-cuspidactylate landhopper, in having simple gnathopod 1, weakly setose anterior margin in gnathopod 2, reduced and plumose-setose peduncle of pleopods, similar spination in uropods 1 and 2, etc. But the latter is distinguished from the former by the possession of a strongly arcuate outer plate and less setose maxilliped. It is interesting that *T. alluaudi* has a weakly arcuate inner plate.

The distribution of *T. alluaudi* in continental areas is believed to be due to synanthropic dispersal (Friend & Lam 1985), and the occurrence is thought to be limited by the humidity (Andersson 1962). Thus it may be astonishing that *T. alluaudi* has been discovered in an arid part of Israel with precipitation as little as 200 mm annually. So far in Israel the present species is known solely from the bamboo stands growing on a small "island" in the middle of a small pool in the University campus at Beersheba. The bamboo, now commonly utilized for gardening in Israel, is an exotic plant for

this country, most of which were imported from West Europe. Thus it is highly probable that the population of *T. alluaudi* in Beersheba was introduced accidentally from European countries with the bamboo and has survived on this small "island," where a humid microclimate may have prevailed.

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Literature Cited

- Andersson, Å. 1962. On a collection of Amphipoda of the family *Talitridae* from the Canary Islands.—*Arkiv för Zoologi* 15(11):211–218.
- Bousfield, E. L. 1984. Recent advances in the systematics and biogeography of landhoppers (Amphipoda: Talitridae) of the Indo-Pacific region.—Pp. 171–210 in F. J. Radovsky, P. H. Raven & S. H. Sohmer, ed., *Biogeography of the tropical Pacific*, Bishop Museum Special Publication 72.
- Chevreux, E. 1896. Recherches zoologiques dans les serres du Muséum de Paris IV.—*Sur un Amphipode terrestre exotique, Talitrus Alluaudi* nov. sp., acclimaté dans les serres du Jardin des Plantes de Paris.—*Feuille des Jeunes Naturalistes* 26:112–113.
- . 1901. Mission scientifique de M.Ch.Alluaud aux îles Séchelles. Crustacés Amphipodes.—*Mémoires de la Société Zoologique de France* 14:388–438.
- , & L. Fage. 1925. *Faune de France* 9. Amphipodes. Paul Lechevalier, Paris, 486 pp.
- Friend, J. A., & P. K. S. Lam. 1985. Occurrence of the terrestrial amphipod *Talitroides topitotum* (Burt) on Hong Kong Island.—*Acta Zootaxonomica Sinica* 10(1):27–33.
- , & A. M. M. Richardson. 1986. Biology of terrestrial amphipods.—*Annual Review of Entomology* 31:25–48.
- Medcof, J. C. 1940. Variations in the pleopod structure of the terrestrial amphipod *Talitrus alluaudi* Chevreux.—*Lloydia* 3(1):79–80.
- Menzel, R. 1911. Exotische Crustaceen im botan-

- ischen Garten zu Basel. — *Revue Suisse de Zoologie* 19:433–444.
- Palmén, E. 1949. *Talitroides alluaudi* (Chevreux) (Amphipoda, Talitridae) in Finnland gefunden. — *Archivum Societatis Zoologicae Botanicæ Fennicæ 'Vanamo'* 2:61–64.
- Shoemaker, C. R. 1936. The occurrence of the terrestrial amphipods, *Talitrus alluaudi* and *Talitrus sylvaticus*, in the United States. — *Journal of the Washington Academy of Sciences* 26(2):60–64.
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